

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Patent Application of:

Arthur W. Chester et al.

Serial No. 09/351,147

Filed: July 12, 1999

For: CATALYTIC PRODUCTION OF LIGHT)
OLEFINS FROM NAPHTHA FEED)

Examiner: Walter D. Griffin

Group Art Unit: 1764

APPELLANTS' BRIEF UNDER 37 CFR 1.192(a)

Fairfax, Virginia 22030

Commissioner for Patents
Washington, D.C. 20231

Sir:

Appellants appeal to the honorable Board of Patent Appeals and Interferences the Primary Examiner's final rejection of the claims set forth in the Office Action of Examiner Griffin mailed October 22, 2001.

As required, the Appeal Brief is being filed in triplicate.

A check in the amount of \$320 is provided herewith for the fee required under 37 CFR 1.17(c). Enclosed is a duplicate copy of this sheet.

1. Real Party in Interest

The real party in interest is ExxonMobil Oil Corporation, formerly Mobil Oil Corporation, of Fairfax, Virginia.

2. Related Appeals and Interferences

No related appeals or interferences exist at this time.

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3. Status of the Claims

Claims 1-10, inclusive, are before the Board for consideration.

4. Status of Amendments

No amendments after final rejection have been filed.

5. Summary of the Invention

The present invention relates to a process for converting C₄+ naphtha hydrocarbon feed over a catalyst comprising ZSM-5, ZSM-11 or combinations thereof treated with phosphorus-containing compound, and a substantially inert matrix material, the catalyst containing less than 20 wt% of active matrix material and having an initial silica/alumina molar ratio of less than about 70. The contacting is carried out under conditions sufficient to produce a product containing light olefins and aromatics.

The process can be used to provide increased yields of ethylene, propylene and high quality motor fuels containing aromatics from low value refinery, petrochemical or other chemical synthesis streams or other naphtha streams, especially in catalytic cracking reactors, e.g., conventional FCC units which ordinarily employ heavier feeds such as deep cut gas oil, vacuum gas oil, thermal oil, residual oil, cycle stock, whole top crude, and the like. A key element of the present invention is its use of a catalyst comprising a zeolite which zeolite itself has been modified by treatment with a phosphorus compound, combined with a substantially inert matrix material. The catalyst comprises a zeolite component that is necessarily treated with a phosphorus compound.

6. Issues

a. Did the Examiner err in finally rejecting Claims 1, 2, 5, 7 and 10 under 35 U.S.C. § 102(b) as being anticipated by EP 0323736?

b. Did the Examiner err in finally rejecting Claims 3, 4 and 6 under 35 USC 103(a) as being unpatentable over EP 0323736?

c. Did the Examiner err in finally rejecting Claims 8 and 9 under 35 USC 103(a) as being unpatentable over EP 0323736, and further in view of U.S. Patent No. 5,898,089 to Drake et al. (Drake)?

7. Grouping of Claims

Appellants submit that Claims 1-7 and 10 stand separate from claims 8 and 9 inasmuch as the latter require co-feeding of steam.

8. Arguments

A. Claims 1, 2, 5, 7 and 10 were finally rejected by the Examiner under 35 USC 102(b) as being anticipated by EP 0323736. EP 0323736 is cited as disclosing a process for converting C₅-C₁₀ paraffinic hydrocarbons into aromatic hydrocarbons and light olefins, wherein the feed can be a coker gasoline, light FCC gasoline, C₅-C₇ fractions of straight run naphthas and pyrolysis gasoline.

The Examiner contends such feeds necessarily boil within the claimed ranges and that the process comprises contacting the feed with a catalyst comprising ZSM-5 or ZSM-11. The Examiner further urges that the reference discloses zeolite with silica to alumina ratio of 100 or less, which "may be treated with a phosphorus compound" (Office Action of October 22, 2001, page 2, bottom line), as well as including a binder material that may be an inactive material such as clay. Inasmuch as the reference does not teach active matrix is required, the Examiner argues that the catalyst contains less than 20 wt.% of active matrix. The Examiner also concludes that the same feed over the same catalyst would inherently provide the same product components required by the present claims. The Examiner has further urged that EP 0323736 teaches introducing phosphorus into the catalyst by arguing that "on page 3, lines 42-54, the reference discloses that the zeolite may include various impregnated oxides such as oxides of phosphorus" (Id. at page 5, lines 13 and 14).

Appellants respectfully disagree with the Examiner's conclusion of anticipation and request the Board to consider the following argument.

EP 0323736 is silent concerning phosphorus treatment of the catalyst except for teaching at page 3, lines 46-49, the use of zeolites which

can be free of oxides incorporated into the zeolites by an impregnation treatment. Thus, these zeolites can be free of oxides incorporated into the zeolites by an impregnation treatment. Examples of such impregnated oxides include oxides of phosphorus as well as those oxides of the metals of Groups IA, IIA, IIIA, IVA, VA, VIA, VIIA, VIIIA, IB, IIB, IIIB, IVB, or VB of the Periodic Chart.

Thus the reference does not *positively* recite introducing phosphorus oxide, but rather teaches that zeolites which have *not* been phosphorus impregnated are suitable for use. To constitute anticipation, all material elements of a claim must be formed in one prior art source. In re Marshall (CCPA 1978) 577 F2d 301, 198 USPQ 344; In re Kalm (CCPA 1967) 378 F2d 959, 154 USPQ 10. Clearly, the reference's teaching that phosphorus oxide-free zeolites can be used does not necessarily imply that phosphorus oxide-containing zeolites are used. Indeed, the reference can be readily construed as teaching away from the present invention, inasmuch as it only positively recites using phosphorus oxide-free materials.

The portion of EP 0323736 (page 3, lines 42 and 43) relied upon by the Examiner does broadly teach that "zeolites suitable for use in the process of the present invention may optionally include *various elements* ion exchanged, impregnated or otherwise deposited thereon" but such a general teaching cannot be fairly argued to disclose or suggest the phosphorus-containing compound treated catalysts required by the present claims. Indeed, the only reference to phosphorus-containing compounds occurs in the context of impregnated oxides of which the reference teaches the catalyst can be free (page 3, lines 46-48).

With respect to the matrix material employed in the present invention, appellants note that the reference specifically teaches that "matrix or binder materials include active *and* inactive materials and synthetic or naturally occurring zeolites as well as inorganic materials such as clays, silica and/or metal oxides, e.g., alumina" (page 4, lines 12-14, emphasis added). There is no requirement or suggestion that the "catalyst contains less than 20 wt.% of active matrix material"

as required by the present claims. Indeed, the reference literally teaches "matrix or binder materials include active *and* inactive materials" contrary to the Examiner's interpretation at page 3, lines 1 and 2 of the October 22, 2001 Office Action that the reference teaches "active matrix material is not required." Appellants note the reference teaches silica and naturally occurring clay as a binder in Example 1 (page 6, lines 11 and 12), but is silent with respect to the activity of the clay used. The reference also teaches blending active zeolite with "sufficient amounts of inert binder material" (page 5, lines 14 and 15), but again is silent respecting the total wt.% active material required by the present claim. Thus the reference fails to provide all material elements of the claims necessary to constitute anticipation.

Accordingly, it is respectfully submitted that one skilled in the art acquainted with the EP reference would not find it obvious to arrive at the invention as presently claimed given the inchoate, anomalous and negative teaching of this reference respecting a) the incorporation of phosphorus in a catalyst for converting naphtha to light olefins and aromatics and b) the "substantially inert" characteristics of the catalyst matrix. In view of this, reversal of the Examiner's final rejection by the Honorable Board is respectfully requested.

B. Claims 3, 4 and 6 were finally rejected by the Examiner under 35 USC 103(a) as being unpatentable over EP 0323736 for the reasons noted above and further in view of the reference's teachings i) that the catalyst also contains a binder material that may be an inactive material such as clay, ii) the ratio of binder to zeolite may be at least 70:30, and iii) conversion conditions include temperatures ranging from 100° to 700°C, a pressure from 10.1 to 720 kPa and a WHSV from 0.5 to 400. The Examiner acknowledges at page four, third paragraph of the October 22, 2001 Office Action that the reference does not disclose the claimed amount of phosphorus in the catalyst or all the claimed reaction conditions. Nevertheless the Examiner reflexively contends it would have been obvious for one skilled in the art at the time the presently claimed invention was made to have a) modified the process of the EP reference by

including phosphorus in the claimed amounts because one would utilize phosphorus amounts including those that are claimed in order to provide a process providing the "desired type of conversion" and b) modified the EP process by using a catalyst/hydrocarbon feed weight ratio within the range claimed because one would utilize any ratio that would result in the effective conversion of the hydrocarbons to the desired product."

Appellants respectfully disagree with the Examiner's conclusion of obviousness and request the Board to consider the following argument.

As argued above, appellants submit that the EP reference fails to disclose or suggest the use of a phosphorus compound-treated catalyst in the process. The only teaching of this reference respecting phosphorus and catalyst relates to use of zeolites which

can be free of oxides incorporated into the zeolites by an impregnation treatment. Thus, these zeolites can be free of oxides incorporated into the zeolites by an impregnation treatment. Examples of such impregnated oxides include oxides of phosphorus (page 3, lines 46-48).

Such a teaching away from phosphorus-treated catalysts clearly fails to provide a disclosure or suggestion of the claimed subject matter of the present application. Accordingly, it is respectfully submitted that the Examiner's reliance upon the EP reference as suggesting the present invention is misplaced. In view of this, reversal of the Examiner's final rejection by the Honorable Board is respectfully requested.

C. The Examiner has also finally rejected claims 8 and 9 under 35 USC 103(a) as being unpatentable over EP 0323736 as applied to claim 1 above, and further in view of U.S. Patent No. 5,898,089 to Drake et al. (Drake). The Examiner notes the EP reference fails to disclose co-feeding steam with the feed and so relies on Drake as disclosing a process for converting a C₄+ naphtha hydrocarbon feed to make light olefins such as ethylene and propylene, as well as aromatics in which steam is co-fed with the feed at a weight ratio of steam ranging from 0.1:1 to about 10:1. The Examiner concludes it would have been

obvious to one of skill in the art at the time the invention was made to have modified the EP process by including steam with the feed in the amount claimed in order to effectively convert the feed to olefins and aromatics. In his Advisory Action of February 21, 2002, the Examiner also urged that one skilled in the art would combine the two references because one would expect the use of steam as disclosed by Drake to result in the effective conversion to desired products in the EP patent's process.

Appellants respectfully disagree with the Examiner's conclusion of obviousness and request the Board to consider the following argument.

Obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, absent some teaching, suggestion or incentive supporting the combination. In re Geiger (CAFC 1987) 815 F2d 686, 2PQ2d 1276; In re Fine (CAFC 1988), 5 USPQ2d 1596. Given the EP reference's teaching against the use of phosphorus-containing catalysts as noted above, it is highly unlikely that one skilled in the art would combine this reference with Drake. Drake discloses using a catalyst comprising acid-treated zeolite, such as ZSM-5, to process fluid C₄-C₃₀ hydrocarbon feed, such as gasolines from cracking processes and naphthas (col. 9, lines 39-46) to convert hydrocarbons to C₆-C₈ aromatic hydrocarbons and olefins. The catalyst is promoted with a wide variety of compounds including phosphorus-containing compounds that can be converted to phosphorus oxide for "reducing coke deposition." The reference is silent concerning use of "substantially inert matrix material" as required by the present application" and teaches an active matrix material, alumina, as preferred binder (column 3, lines 17-18), although the reference also teaches the presence of clay in the catalyst.

Drake is also completely silent concerning the silica to alumina molar ratio of its catalyst. There is no suggestion or disclosure that the catalyst should contain the "relatively high silica zeolites" having an initial silica/alumina molar ratio of not greater than 70, or preferably above 5 which the present invention requires (see, specification at page 8, lines 30 to 32). It is thus respectfully urged that despite

Drake's teachings concerning the co-feeding of steam, one skilled in the art would lack any incentive to combine these two references.

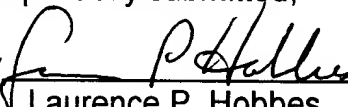
Accordingly, it is respectfully submitted that the present claims meet the requirements of 35 USC 103(a) notwithstanding the teachings of the EP reference and Drake. In view of this, reversal of this rejection by the Honorable Board is respectfully requested.

CONCLUSION

Appellants respectfully submit that the foregoing arguments obviate all of the outstanding rejections in this case and place the application in condition for immediate allowance. Allowance of this application is therefore earnestly solicited.

Respectfully submitted,

By



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March 18, 2002

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9. APPENDIX

CLAIMS:

1. A process for converting a C₄+ naphtha hydrocarbon feed to a product which includes light olefins and aromatics, comprising:

contacting said feed with a catalyst comprising ZSM-5, ZSM-11 or combinations thereof treated with a phosphorus-containing compound, and a substantially inert matrix material, wherein said catalyst contains less than 20 wt% of active matrix material and has an initial silica/alumina molar ratio less than about 70, said contacting being effected under conditions to produce a product containing light olefins and aromatics.

2. The process of Claim 1 wherein the C₄+ naphtha hydrocarbon feed includes feeds having boiling point ranges from about 80°F (27°C) up to about 430°F (221°C).

3. The process of Claim 1 wherein the zeolite makes up about 5 to 75 wt.% of the catalyst, the substantially inert matrix material makes up about 25 to about 95 wt.% of the catalyst and phosphorus is present in amount of about 0.5 to 10 wt.% of the catalyst.

4. The process of Claim 3, wherein the zeolite has an initial silica/alumina molar ratio ranging from about 5 to about 30.

5. The process of Claim 1 wherein the substantially inert matrix material comprises silica, clay or mixtures thereof.

6. The process of Claim 1 wherein said conditions comprise a temperature of from about 950°F (510°C) up to about 1300°F (704.4°C), a hydrocarbon partial pressure from about 2 to about 115 psia (0.1 to about 8 bar),

a catalyst/hydrocarbon feed weight ratio from about 0.01 to about 30, and a WHSV from about 1 to about 20 hr⁻¹.

7. The process of Claim 1 wherein the product comprises ethylene and propylene, with a C₂=/C₃= wt. ratio greater than 0.39, and increased amounts of toluene and xylene relative to the hydrocarbon feed.

8. The process of Claim 1 further comprising co-feeding steam under conversion conditions in an amount from about 5 to about 30 wt % of the steam/feed mixture.

9. The process of Claim 8 wherein the product comprises ethylene and propylene, with a C₂=/C₃= wt. ratio greater than about 0.6, and increased amounts of toluene and xylene relative to the hydrocarbon feed.

10. The process of Claim 1 wherein the light olefins in the product comprise ethylene plus propylene in an amount greater than about 25 wt.% based on total product.

TABLE OF CASES

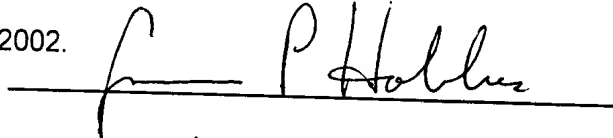
1. In re Marshall (CCPA 1978) 577 F2d 301, 198 USPQ 344
2. In re Kalm (CCPA 1967) 378 F2d 959, 154 USPQ 10.
3. In re Geiger (CAFC 1987) 815 F2d 686, 2PQ2d 1276;
4. In re Fine (CAFC 1988), 5 USPQ2d.

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on March 18, 2002.

A handwritten signature in dark ink, appearing to read "L P Hobbes", is written over a horizontal line.

Laurence P. Hobbes